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Record of Decision:

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FINAL RECORD OF DECISION AND RESPONSIVENESS SUMMARY FOR OPERABLE UNIT 1 DEFENSE DEPOT OGDEN, UTAH

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Defense Depot Ogden, Utah
Operable Unit 1

Declaration for the Record of Decision

DDOU OPERABLE UNIT 1

DECLARATION
FOR THE
RECORD OF DECISION

Site Name and Location

Defense Depot Ogden, Utah
Ogden, Weber County, Utah
Operable Unit 1 - Burial Sites 1, 3-B, and the Plain City Canal Backfill

Statement of Basis and Purpose

This decision document presents the remedy for Defense Depot Ogden, Utah (DDOU) Operable Unit 1 (OU 1) selected in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record for DDOU OU 1.

The State of Utah and the U.S. Environmental Protection Agency (EPA) concur on the selected remedy presented in this Record of Decision (ROD).

Assessment of the Site

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, and the environment.

Description of the Selected Remedy

Operable Unit 1 is one of four operable units at the DDOU National Priority List (NPL) site for which a remedial investigation/feasibility study (RI/FS) has been conducted. The role of the OU 1 RI/FS is to investigate the nature and extent of contamination present at OU 1, to investigate the principal threats to human health and the environment posed by those contaminants, and to develop a remediation alternative for reducing those threats. Operable Unit 1 is composed of Burial Sites 1, 3-B, and the backfill material in the Plain City Canal. Burial Site 1 was reportedly used for the disposal of riot control agent (chloroacetophenone) and white smoke (hexachloroethane) containers. Only non-toxic materials were placed in Burial Site 3-B, including over 1,000 arctic-style rubber boots. Of the three potential sources of contamination at OU 1, only the backfill in the Plain City Canal has been identified as a source of ground-water contamination. Backfill in the Plain City Canal consists of glass, ash, charcoal, asphalt, partially burned plastic-coated electrical wire, wood, concrete, plastic, and metal fragments mixed with silty sand and gravel.

In general, only semi-volatile organic contaminants, pesticides, polychlorinated biphenyls (PCBs), dioxins, and furans were detected in the soil at OU 1, and they are in the localized area of the Plain City Canal. Volatile organic compounds (VOCs) were not detected in the Plain City Canal soils and debris.

The ground water in the shallow aquifer underlying OU 1 is contaminated by a variety of VOC breakdown products including vinyl chloride and cis-1,2-dichloroethene (cis-1,2-DCE). The Plain City Canal soils and debris are considered the original source of these contaminants. While the contaminants are no longer detectable in this material, traces of contamination or hot spots may be present that were not located during the site investigation.

Currently, there is no complete exposure pathway to contaminants present at OU 1. However, future threats to human health and the environment at OU 1 include exposure to PCBs, dioxins, and furans in the soil and debris of the Plain City Canal and the potential for exposure to VOCs in the shallow ground water. The remedy will remove these potential threats by excavating the contaminated soil and removing the ground-water contaminants through treatment.

The selected remedy for DDOU OU 1 consists of the following:

- Excavation and transport of contaminated soil and debris off site for disposal in a RCRA permitted hazardous waste or industrial landfill.

- Extraction of contaminated ground water, treatment by air stripping and carbon adsorption, and reinjection into the shallow aquifer.

- Monitor ground water to ensure the effectiveness of the ground-water treatment alternative.

This alternative will control potential future exposures and risks associated with contaminated soil in the Plain City Canal and in the shallow ground water.

Statutory Determinations

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and treatment technologies to the maximum extent practicable and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element, with respect to the remediation of ground water.
Because treatment of soils was not found to be practicable, the disposal of soils off site does not satisfy the statutory preference for treatment as a principal element. In order to ensure that ground-water treatment continues to provide adequate protection of human health and the environment, a review will be conducted by DDOU within five years after commencement of the remedial action.

Defense Depot Ogden, Utah
Operable Unit 1

Decision Summary for the Record of Decision

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DECISION SUMMARY
FOR THE RECORD OF DECISION

1.0 SITE NAME, LOCATION, AND DESCRIPTION

Defense Depot Ogden, Utah (DDOU) is located at 1200 South Street and 500 West in the northwest part of the City of Ogden, Weber County, Utah as depicted in Figure 1. The DDOU facility has been a key installation in the Department of Defense (DOD) supply system since September 15, 1941.

Situated in a semi-rural setting with the small communities of Harrisville (population 2,500) 1.5 miles to the north, Farr West (population 1,750) 3 miles to the northwest, numerous small ranches and a few small businesses located to the west, east, and south, DDOU covers approximately 1,100 acres within the Great Salt Lake Valley. Located approximately 1.5 miles to the northwest is the Walquist Junior High School. A residential area is located approximately one mile east of the Plain City Canal, but this is upgradient of the source of ground-water contamination. The nearest off-Base residence is located about one-quarter mile to the west. Mill and Four-Mile Creeks flow east to west and drain the topographically flat area of the installation.

The Depot is underlain by unconsolidated lacustrine and alluvial deposits of Quaternary and Recent age. An unused shallow water table aquifer, ranging in thickness from approximately 20 to 30 feet, underlies Operable Unit 1 (OU 1). The shallow aquifer is classified by the State of Utah as a Class II Aquifer a potential future source of drinking water. Ground-water flow in the shallow aquifer underlying OU 1 is toward the northwest. A deeper, confined aquifer has been encountered at a depth of approximately 110 to 125 feet below the ground surface in the northern part of DDOU. Where encountered, this aquifer exhibits artesian conditions with water levels in the wells rising above the ground surface. Regional studies indicate that there may be some hydraulic connection between the shallow and deep aquifers. The strong upward gradient that currently exists could potentially change in the future as a result of excessive pumping of ground water from the deeper aquifers.

In the past, both liquid and solid materials have been disposed of at DDOU. Oily liquid materials and combustible solvents were burned in pits, and solid materials were buried, burned, or taken off site for disposal. Several waste disposal areas have been identified on property currently or formerly controlled by DDOU, and divided into four operable units. Under the National Oil and Hazardous Substance Pollution Contingency Plan (NCP), "an operable unit is a discrete part of a remedial action that can function independently as a unit and contributes to preventing or minimizing a release or threat of a release." This Record of Decision (ROD) addresses Operable Unit 1.

Operable Unit 1, which is located in the southwest part of DDOU (Figure 1), is composed of the backfill material in the Plain City Canal, Burial Site 1, and Burial Site 3-B. Analysis of soil samples revealed that the soil in the Plain City Canal has been contaminated with polychlorinated biphenyls (PCBs), dioxins, and furans.

Analysis of ground-water samples from monitoring wells installed in the vicinity of OU 1 indicate that ground water in the shallow aquifer underlying OU 1 is contaminated with volatile organic compounds (VOCs) including trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), and vinyl chloride (VCL). Of these contaminants, only VCL and cis-1,2-DCE are widespread at OU 1, and only VCL and TCE exceed their maximum contaminant levels (MCLs) of 2 micrograms per liter (g/L) and 5 g/L, respectively. An MCL is the maximum concentration of a contaminant permitted in public drinking water.

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.1 HISTORY

Burial Site 1. Located adjacent to the southwest corner of the Depot, Burial Site 1 lies outside the existing DDOU property boundary (Figure 1). The land surrounding Burial Site 1 is undeveloped and used by visitors to the Ogden Nature Center. A trench near the center of Burial Site 1 was reported to have been used for the disposal of riot control agent (chloroacetophenone) and white smoke (hexachloroethane) containers in about 1945. In 1985, a series of magnetic surveys located buried ferrous materials. A disturbed area was identified near the central portion of the site. Field observations made during the 1985 study reported corroded 55-gallon drums and smaller canisters present on the ground surface near the center of Burial Site 1, adjacent to the backfilled trench. In addition, an aerial photograph taken in 1958 shows a disturbed zone near the southwest corner of the site.

Burial Site 3-B. Burial Site 3-B (Figure 1), was reportedly the location of over 1,000 arctic-style rubber boots buried during the early 1960s. However, no evidence of these materials was obtained from soil borings drilled in this area.

Plain City Canal Backfill. The Plain City Canal was an irrigation canal that flowed northwest between two branches of Mill Creek until it was backfilled with burning-pit debris from Burial Site 4-A during the period from 1969 to 1973. A soil-gas survey-conducted during the summer of 1988 revealed that a portion of the Plain City Canal backfill was the apparent source of elevated VOCs in the soil gas. Soil borings drilled in the Plain City Canal backfill revealed the presence of debris consisting of glass, ash, charcoal, asphalt, partially burned plastic-coated electrical wire, wood, concrete, plastic, and metal fragments. The debris is buried from 1 ½ feet to 5 feet below ground surface in a channel that is 20 feet wide. Figure 1 depicts the areal extent of the debris backfill.

2.2 ENFORCEMENT HISTORY

A records search in 1979 by the U.S. Army Toxic and Hazardous Materials Agency identified three locations on DDOU where hazardous materials might have been used, stored, treated, or disposed of. These locations were recommended for further study. Defense Depot Ogden, Utah was proposed for inclusion on the National Priorities List (NPL) in 1984 and the decision was finalized in July of 1987. As a result, the Defense Logistics Agency (DLA) conducted a study to determine the location of any past disposal sites and the potential for ground-water contamination resulting from those sites.

On June 30, 1986, DDOU entered into a Memorandum of Agreement with the State of Utah Department of Health (UDOH) and the U.S. Environmental Protection Agency (EPA) to undertake a remedial investigation/ feasibility study (RI/FS) under the Installation Restoration Program.

In November of 1989, DDOU entered into a Federal Facility Agreement (FFA) with EPA and UDOH. The propose of the agreement was to establish a procedural framework and schedule for developing, implementing, and monitoring appropriate response actions at DDOU in accordance with existing regulations. The FFA requires the submittal of several primary and secondary documents for each of the four operable units at DDOU. This ROD concludes all of the RI/FS requirements for OU 1.

2.3 INVESTIGATION HISTORY

In 1981, ten shallow monitoring wells were installed at DDOU, including two wells in the vicinity of OU 1. Analysis of the ground water sampled from these wells indicated the presence of VOCs.

In 1985 and 1986, an investigation and evaluation of the hydrogeology and delineation of hazardous waste disposal areas of the various DDOU site was conducted. Four additional monitoring wells and two soil borings were installed in the vicinity of OU 1. Analysis of the ground water sampled from both sets of wells indicated the presence of VOCs in samples from two wells downgradient of the Plain City Canal.

Samples of surface water and sediment were taken from Mill Creek during the spring of 1985 to determine surface-water and sediment quality in the vicinity of OU 1. A second set of samples were taken in January of 1990. None of the contaminants detected exceeded maximum contaminant levels in Mill Creek waters downstream of OU 1, and contaminants detected in sediment samples downstream of OU 1 were detected at similar levels in the off-Depot sampling point upstream of OU 1.

During the summer and fall of 1988, site characterization activities included a soil-gas investigation, drilling and sampling of soil borings, installation of shallow monitoring wells, and sampling and analysis of all monitoring wells installed at DDOU. A water well survey was conducted and a list of potential human, plant, and animal receptors was developed and used in the preparation of an endangerment assessment. In general, results of the site characterization activities indicated the presence of VOCs in the soil gas and ground water underlying the site.

Further site characterization activities conducted during November and December of 1989 and January of 1990, included excavation and sampling of test pits, drilling and sampling of additional shallow soil borings, and installation and sampling of additional shallow ground-water monitoring wells. Results of this site characterization confirmed the presence of VOCs in the shallow ground water underlying OU 1. Vinyl chloride exceeded the MCL in one sample. The only VOC detected in soil samples was cis-1,2-dichloroethene, which was found in one soil sample from below the water table. The detection of this contaminant in soil was attributed to its presence in ground water at the same location. Pesticides, PCBs, dioxins, and furans were also detected at low concentrations in test pit soil samples from the Plain City Canal backfill material.

Additional site characterization activities were conducted in July and August of 1990 with the installation of more shallow ground-water monitoring wells and soil borings. Sample analysis detected PCBs, dioxins, and furans in soil samples from the Plain City Canal and VOCs were detected in shallow ground-water samples.

Site characterization activities, conducted in April of 1991 included installation and sampling of soil borings in the Plain City Canal backfill and sampling of selected shallow monitoring wells to determine the extent of contamination. No VOCs were detected in soil samples from the Plain City Canal, but pesticides were detected at concentrations similar to those detected in background soil samples. Analytical results of ground-water samples confirmed the presence and extent of VOC ground-water contamination at OU 1.

2.4 COMMUNITY RELATIONS HISTORY

The RI/FS Report and the Proposed Plan for DDOU OU 1 were released to the public on July 26, 1991 and October 3, 1991, respectively. These documents were made available to the public in both the Administrative Record and an information repository maintained at the Weber County Library. The notice of availability for these two documents was published in the Salt Lake Tribune, the Deseret News, and the Ogden Standard Examiner on October 3, 4, and 5, 1991.

A public comment period was held from October 3, 1991 through November 3, 1991 and a public meeting was held on October 17, 1991 as part of the community relations plan for OU 1. At the public meeting, representatives from DDOU, EPA, and the State of Utah presented the preferred alternative and answered questions. A court reporter prepared a transcript of the meeting. A copy of the transcript and all written comments received during the comment period have been placed in the Administrative Record. In addition, copies of the transcript were sent to all of the meeting attendees who requested one. A response to the comments received during this period is included in the Responsiveness Summary, which is part of this ROD. This decision document presents the selected remedial action for DDOU OU 1, chosen in accordance with CERCLA, as amended by SARA and, to the extent practicable, the NCP. The decision on the selected remedy for this site is based on the Administrative Record.

2.5 SCOPE AND ROLE OF OPERABLE UNIT 1

Defense Depot Ogden, Utah, with concurrence from the State of Utah and EPA, has elected to divide the site into four operable units. The remedial actions planned at each of the four operable units are, to the extent practicable, independent of one another. However, with respect to OU 1 and OU 3, the close proximity of these two operable units has resulted in some interrelationships between the remedial actions at each operable unit. For example, a portion of Burial Site 3-A in OU 3 has been shown to be a source of groundwater contamination. Therefore, this area will need to be cleaned up as part of the remedy for OU 3 to ensure that the remedy for OU 1 can achieve the remediation goals selected.

The role of the remedial action for OU 1 is to reduce the principal threats posed by contaminated soil and shallow ground water that may occur as a result of future exposure of residents or on-Depot workers. This will be done by removing a source of VOC contamination in soil and remediating contaminated shallow ground water for beneficial use in the future. The remedy for OU 1 is the second final response action for the DDOU site. The remedy for OU 2 is currently under construction.

3.0 SITE CHARACTERIZATION

3.1 NATURE AND EXTENT OF CONTAMINATION

3.1.1 Nature and Extent of Soil Contamination

Plain City Canal. No VOCs have been detected in the Plain City Canal backfill, however pesticides, PCBs, metals, dioxins, and furans have been detected. The pesticides dichlorodiphenyldichloroethane (DDD),dichlorodiphenyldichloroethene (DDE), and dichlorodiphenyltrichloroethane (DDT) were detected in five samples at depths ranging from about 1.5 to 6 feet at concentrations ranging from 0.006 to 1.9 milligrams/kilogram (mg/kg). These concentrations are consistent with pesticide concentrations detected at other operable units at DDOU and appear to be related to the historic use of pesticides on Depot. PCBs were detected in the backfill at two sample locations at depths between 3 and 10.5 feet at concentrations of 0.5 to 3.6 mg/kg. Four metals (lead, zinc, barium, and cadmium) were detected in the Plain City Canal backfill at concentrations above calculated background concentration for DDOU soils in uncontaminated areas. Of the metals contaminants detected, lead and zinc were found most frequently. Lead concentrations in the debris material ranged from 7.5 to 1,000 mg/kg, compared to a background concentration of 16 mg/kg. Zinc concentrations in the debris material ranged from 37 to 11,000 mg/kg, compared to a background concentration of 52 mg/kg. Extraction Procedure (EP) toxicity metals analyses were performed on two samples collected from the backfill. Of the eight EP toxicity metals, only barium and cadmium were detected in the EP toxicity extract but at levels well below the EP toxicity limits for these elements.

Dioxin and furan isomers were detected in several samples from 1.0 to 6.5 feet below the ground surface in the backfill. The concentrations of the dioxin and furan isomers detected in the samples ranged from non-detection to 11,000 picograms per gram (pg/g) or parts per trillion. However, in terms of an equivalent concentration of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), all the dioxin and furan isomers detected in the most contaminated sample produced a concentration of only 0.026 parts per billion.

The volume of contaminated soil and debris in the Plain City Canal is estimated at 4,000 cubic yards, based on a length of approximately 1,200 feet, width of 20 feet, and contaminated soil thickness of 4 feet.

3.1.2 Nature and Extent of Ground-Water Contamination

The distribution of VOCs detected in the shallow ground-water aquifer underlying OU 1 is depicted in Figure 2. The major source of VOCs in ground water appears to be the Plain City Canal backfill and Burial Site 3-A (part of OU 3). While no VOC contaminants have been detected in the PCC backfill, contaminants may still be present at levels below the detection limit or in hot spots. The Burial Site 3-A source area will be remediated, if necessary, under the remedy for Operable Unit 3.

While the total VOC concentration in each monitoring well is generally less than 10 ug/L, vinyl chloride and TCE were detected at concentrations exceeding their MCLs. Trichloroethene was detected above its MCL of 5 ug/L in only one sample from a monitoring well that is located in Burial Site 3-A. The most widespread VOCs detected in the shallow ground water at OU 1 are vinyl chloride and cis-1,2-DCE, both of which are degradation products of TCE. Of these two contaminants, only vinyl chloride was detected at concentrations in excess of its MCL of 2 ug/L. The total areal extent of the zone of ground water containing vinyl chloride at concentrations above 2 ug/L, as depicted on Figure 2, is estimated to be 32 acres and the total volume of ground water within this area is estimated to be approximately 56 million gallons. This estimate is based on the assumption that the entire thickness of the aquifer is contaminated within the defined area. No evidence of a dense non-aqueous phase liquid (DNAPL) was detected during monitoring of OU 1 ground water.

During the July and August 1990 sampling round, dioxin and furan isomers were detected in sediment-laden ground-water samples collected from monitoring wells located in the Plain City Canal at concentrations of up to 2,400 picograms per liter (pg/L) or parts per quadrillion. However, during the April 1991 sampling round, these contaminants were not detected in sediment-free ground-water samples. The earlier detection of the dioxins and furans in the ground water has been attributed to adsorption of dioxins and furans that originated in the debris from the Plain City Canal, to silt and clay particles in the shallow aquifer.

3.2 PUBLIC HEALTH AND ENVIRONMENTAL IMPACTS

A baseline risk assessment was conducted for OU 1 following completion of the site characterization activities. The purpose of the assessment was to determine the most significant contaminants present at OU 1, the different ways by which people, plants, and animals would potentially come into contact with the contaminants, and the probability of any harmful effects occurring as a result of that contact. Based on the results of the baseline risk assessment, the media of concern for OU 1 were determined to be the ground water underlying OU 1 and the backfill within the Plain City Canal. Surface water was not considered a medium of concern for OU 1 because investigations of surface water and sediments did not detect any contamination related to OU 1 contaminants. In addition, upstream and downstream concentrations of contaminants are similar.

The health risk assessment for OU 1 indicates that there are no currently complete, significant exposure pathways within OU 1. However, contaminants in the Plain City Canal soil could pose a future risk to human health. If the contaminated shallow ground water is used for domestic purposes in the future, there would be a potential for carcinogenic health effects. No current or future environmental effects are expected to occur as a result of contaminants present at OU 1.

3.2.1 Contaminant Identification

The initial step of the risk assessment was the selection of indicator chemicals. The indicator chemical selection process used in the risk assessment was designed to focus on those chemicals that are the most toxic and were anticipated to result in greatest human exposure. An indicator chemical was selected based on the potential route of exposure and the particular chemical's carcinogenic and non-carcinogenic toxicity. Specifically, the indicator chemicals were selected on the basis of an index calculated as the product of their maximum measured concentrations in the medium of concern and their toxicity. Toxicity was measured by the slope factor and the reciprocal of reference dose for carcinogenic and non-carcinogenic health effects, respectively. The frequency of detection was also included as a criterion for selection of ground-water indicator chemicals. Indicator chemicals for carcinogenic health effects for soil and their maximum concentrations were PCBs (3.6 mg/kg), 2,3,7,8-TCDD (0.000026 mg/kg), arsenic (19 mg/kg), cadmium (9.8 mg/kg), and chromium (39 mg/kg). Carcinogenic indicator chemicals for ground water were 1,1-dichloroethene (1.8 ug/L), trichloroethene (1.6 ug/L), vinyl chloride (10 ug/L), and 2,3,7,8-TCDD (0.00000092 ug/L). Indicator chemicals for non-carcinogenic health effects for soil and their maximum concentrations were arsenic, barium (350 mg/kg), chromium, lead (1,000 mg/kg), nickel (57 mg/kg), and zinc (11,000 mg/kg). Non-carcinogenic indicator chemicals for ground water were cis-1,2-DCE (26 ug/L) and vinyl chloride.

3.2.2 Exposure Assessment

No current exposure pathways were considered complete. A significant potential future exposure to OU 1 ground-water contaminants exists for offsite and on-site residents who use shallow ground water from a well installed in the OU 1 ground-water contaminant plume, and could therefore ingest contaminants in drinking water, and inhale and dermally adsorb contaminants in a shower. Future exposure to ground-water contaminants could also occur for on-site residents who consume crops or livestock exposed to contaminated water through the food chain. Future significant exposure scenarios to soil could include exposure of construction workers to dioxins, furans, and heavy metals during excavation activities in the Plain City Canal backfill. Not quantitatively evaluated, but potentially significant, would be the ingestion of soil by future residents, especially children. Because the remedy for OU 1 was not based on the results of risk assessment, but rather upon ARARs for ground water and prevention of future ground-water contamination for soil, chronic daily intake factors for each contaminant for each exposure pathway are not presented here. However, the contaminants of concern, their maximum concentration, and the associated risks for soil and ground water at OU 1 are presented in Tables A-1 and A-2 of Appendix A.

3.2.3 Toxicity Assessment

Cancer slope factors have been developed for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. Reference doses have been developed for indicating potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. All carcinogenic compounds had slope factors except for PCBs, which did not have an inhalation slope factor for use in evaluating the risk to construction workers from inhalation of contaminated dust. No reference doses were available for lead; no inhalation reference doses were available for cis-1,2-DCE, arsenic, cadmium, nickel, or zinc. Because the remedy for OU 1 was not based on the risk assessment, the values of reference doses and slope factors and their sources are not presented here.

3.2.4 Risk Characterization

Excess lifetime cancer risks (sometimes referred to as carcinogenic risks) are determined by multiplying the intake by the cancer slope factor. These risks are probabilities that are generally expressed in scientific notation (e.g., 1 x 10[-6]). An excess lifetime cancer risk of 1 x 10[-6] indicates that, as a plausible upper bound, an individual has a one in a million chance of developing cancer as a result of chronic site-related exposure to carcinogens over a 70-year lifetime under the specific exposure conditions at the site. The target risk level for a site is 1 x 10[-6], although a value in the range of 1 x 10[-4] to 1 x 10[-6] may be acceptable.

Potential concern for noncarcinogenic effects of a single contaminant in a single medium is expressed as the hazard quotient. By adding the hazard quotient for all contaminants within a medium and across all media to which a given population may reasonably be exposed, a hazard index can be generated. A hazard index greater than 1 indicates that there may be a concern for potential health effects, while a hazard index less than 1 indicates that the concern for potential health effects is quite low.

The potential carcinogenic risk to future off-site residents who use the shallow ground water at the western boundary over a period of 30 years is on the order of 3 x 10[-5]. The total hazard index for noncarcinogenic effects to future off-site residents is on the order of 0.7. The estimated carcinogenic risk to potential future on-site residents is on the order of 1 x 10[-4], and the total hazard index is estimated as 2. These are significant risks. The potential carcinogenic and non-carcinogenic risks to future construction workers who become exposed to contaminated soils in the Plain City Canal over a period of two years are 7 x 10[-6] and 0.8, indicating that the risks associated with this scenario may be, but are not necessarily, acceptable. The use of contaminated irrigation water could lead to a cancer risk of 3 x 10[-7], which is insignificant.

No significant environmental threats appear to be associated with OU 1. The only area where ecological receptors could possibly come into contact with contaminants is through the water and sediments of Mill Creek. However, because Mill Creek only flows part of the year, it is a small area, and it is not a critical habitat for wildlife in the area. With the exception of 1985 sampling results for antimony, concentrations of metals are similar in samples taken upstream and downstream of OU 1. This indicates a low potential for impact on ecological receptors. Finally, because the contaminants associated with disposal activities at OU 1 have not been detected in surface water or sediments, it appears that contamination at OU 1 is not migrating to Mill Creek, and would not be expected to have an impact on Mill Creek in the future.

3.2.5 Uncertainties

The primary uncertainty associated with the exposure pathway of greatest concern, ingestion of ground water by future on-site or off-site residents, is whether or not the pathway will become complete in the future. A second uncertainty is associated with the fact that all of the estimates of the total hazard index for exposure through ground water are incomplete, and therefore low due to a lack of reference doses for some compounds. Additional uncertainty is related to the assumption that contaminant concentrations will remain constant with time and unknowns associated with dermal uptake of some indicator chemicals. With respect to exposure to contaminated soil, there is uncertainty associated with the estimate of dust inhalation and ingestion rates, and the bioavailability of contaminants.

The potential for contaminant exposure by future residents through ingesting contaminated soil was not evaluated. The risks for this exposure may be potentially greater than were estimated for the construction worker scenario. However, because the two scenarios involve the same parcel of contaminated soil, a remedy that addresses risks to construction workers will also address potential risks to future residents.

3.2.6 Summary of Site Risks

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial danger to public health, welfare, or the environment. There are no current significant risks to human health and the environment from exposure to soil or ground water at OU 1, nor are significant risks likely to develop in the future as long as the Depot remains in existence. Under future residential site use conditions, risks may exceed EPA's point of departure of one in one million excess lifetime cancer risk or a total hazard index of one. In addition, the Plain City Canal backfill is a source of the contamination detected in the shallow aquifer ground water.

4.0 ALTERNATIVES EVALUATION

As part of the DDOU OU 1 feasibility study, six soil and seven ground-water remedial alternatives were developed. Under Section 121 of SARA, the selected remedial action must be protective of human health and the environment, cost effective, and attain Federal and State applicable or relevant and appropriate requirements (ARARs). The selected alternative must also use permanent solutions and alternative treatment or resource recovery technologies to the maximum extent practicable. Remedies that employ treatment which permanently and significantly reduces the mobility, toxicity, or volume of hazardous substances is a statutory preference. This section summarizes how the remedy selection process for OU 1 addressed these requirements.

4.1 DEVELOPMENT OF PRELIMINARY ALTERNATIVES

Preliminary alternatives that represent the range of available remediation options were developed starting with the no-action alternative. Subsequent alternatives represented an increasing degree of technical complexity. Each alternative contained different processes and extent of remediation for soil and ground water.

The main features of the preliminary alternatives for soils were:

1. No Action -No remedial action would be taken to reduce the levels of contamination in the soil at OU 1.

2. Institutional Controls - Legal and administrative actions would be imposed to limit potential exposure under both current and future use scenarios.

3. Containment - Contaminant migration from soil to ground water would be controlled by reducing infiltration after constructing an engineered cap over the Plain City Canal backfill material and containment by a slurry cut-off wall. Alternatively, the contaminated soil could be excavated and placed in an on-site Resource Conservation and Recovery Act (RCRA) hazardous waste landfill.

4. Off-Site Soil Disposal - Contaminated soil would be excavated and transported off site for incineration or for disposal in a RCRA permitted hazardous waste or industrial landfill according to classification of the soil and debris during excavation.

5. On-Site Soil Treatment - Contaminated soil would be excavated and treated on site using chemical or incineration technologies. Treated soil would be returned to the excavation if suitable or the residue would be disposed of off-site.

6. In-Situ Soil Treatment - Contaminated soil would be immobilized in place using soil vitrification technology.

Ground water contaminated by vinyl chloride is the principal threat posed by OU 1. Therefore, removal of vinyl chloride is the primary concern for ground-water remediation. If dioxin and furan concentrations are detected at levels that produce a health risk of greater than one in ten thousand, dioxins and furans will be removed from the ground water by a granulated activated carbon (GAC) system.

As DDOU has four operable units currently undergoing RI/FS or remedial design evaluations, the potential exists for consolidation or sharing of treatment facilities or process options between operable units, especially when the nature of contamination is similar between the areas. Shallow ground water beneath OU 2, located less than one mile from OU 1, will be treated by air stripping and GAC. As some economy of scale may be obtained by building only one treatment plant for ground-water remediation at the two operable units, several alternatives were developed to investigate this possibility.

1. No Action - Ground-water monitoring would continue (this is an element common to all alternatives), but no active remedial actions would be taken to reduce the levels of contamination.

2. Institutional Action - Legal and administrative actions would be imposed, as necessary, to limit potential exposures under both the current and future use scenarios. For example, steps would be taken to block out water rights for downgradient areas to prevent the possible future use of shallow ground water.

3. Containment - Contaminant migration potential would be reduced by controlling ground-water movement by installing upgradient subsurface barriers at the southeast end of the vinyl chloride contaminant plume.

4. Air Stripping/GAC at OU 1 with Recharge at OU 1 - Contaminated ground water would be extracted through wells or trenches, treated by air stripping and GAC, and reinjected into the aquifer at OU 1.

5. Air Stripping/GAC at OU 1/OU 2 with Recharge at OU 1 Contaminated ground water would be removed by wells or trenches, treated by air stripping and GAC at a combined OU 1 and OU 2 treatment facility and reinjected near OU1.

6. Air Stripping/GAC at OU 1/OU 2 with Recharge at OU 2 Contaminated ground water would be removed by wells or trenches, treated by air stripping and GAC at a combined OU 1 and OU 2 treatment facility and reinjected at OU 2.

7. Spray Aeration to Lined Pond Followed by GAC Treatment and Recharge at OU 1 by Injection Wells or Trenches - Contaminated ground water would be removed by wells or trenches, sprayed into a lined pond, pumped through a GAC treatment system, and reinjected into the aquifer at OU 1.

4.2 INITIAL SCREENING OF PRELIMINARY ALTERNATIVES

Preliminary alternatives were screened using three broad criteria: effectiveness, implementability, and cost. The purpose of this screening was to reduce the number of alternatives requiring detailed analysis. Comparisons were made among those alternatives that offered similar functions or extent of remediation. The most promising were compared in a detailed analysis. Tables 1 and 2 indicate how each alternative compared with the three major criteria for soil and ground-water remediation, respectively.

The end result of the screening process was a shortened list of alternatives that were recommended for detailed analysis. The initial screening retained those alternatives that appeared more effective, easier to implement, and less costly than other alternatives offering a similar level of protection or extent of remediation.

Remediation alternatives were formulated by combining selected soil and ground-water remediation alternatives. All of the remediation alternatives share continued monitoring of ground-water quality as a common element. The remediation alternatives for OU 1 are listed below:

Alternative 1 - No Action

Alternative 2 - Off-Site Landfill Disposal of Soil and Ground Water Treatment by Air Stripping/GAC

Alternative 3 - Off-Site Soil Incineration and Ground-Water Treatment by Air Stripping/GAC

Alternative 4 - Off-Site Landfill Disposal of Soil and Ground Water Treatment by Spray Aeration/GAC

Alternative 5 - Off-Site Soil Incineration and Ground-Water Treatment by Spray Aeration/GAC.

4.3 DESCRIPTION OF ALTERNATIVES

4.3.1 Alternative 1 - No Action

Ground-water monitoring would continue (ground-water remedial Alternative 1), but no active remedial actions would be taken to reduce the levels of ground-water contamination or to remove the potential source of these contaminants in the soils of the Plain City Canal (soil remedial Alternative 1). Therefore, Alternative 1 does not reduce the risk to human health and the environment and a no-action alternative is not required to comply with ARARs. The indirect, capital, operating and maintenance costs associated with this alternative are presented in Table 3, as are estimates of present net worth costs based on a 20 year monitoring period and a statutory review every 5 years.

4.3.2 Alternative 2 - Off-Site Landfill Disposal of Soil and Ground-Water Treatment by Air Stripping/GAC

After removing 1 to 2 feet of clean fill overlying the Plain City Canal backfill, approximately 4,000 cubic yards of soil and debris in the Plain City Canal would be excavated and transported to an off-site facility for placement in a RCRA hazardous waste or industrial waste landfill, depending on RCRA classification of the soil and debris. While this material does not present a significant hazard to human health, excavation and off-site landfill disposal would reduce the risk to the environment by removing the potential source of vinyl chloride, dioxin, and furan contamination observed in the ground water. Excavation would continue until soils remaining on site contain less than 25 mg/kg of PCBs, less than 1 ug/kg total equivalent 2,3,7,8-TCDD, and present a health risk of less than one in ten thousand, with a target of one in one million for the remaining contaminants. The excavation would then be backfilled with clean fill. This alternative would achieve clean closure of the source area. This cleanup action would take a few months to complete and would be conducted approximately 15 months to two years after the ROD is signed.

Because the concentrations of contaminants within the soils and debris in the Plain City Canal are below the concentration levels that would remain after implementing the RCRA treatment standards for F001 through F005 listed wastes, land disposal would comply with the applicable requirements of RCRA land disposal restrictions (40 CFR part 268) and State regulations (UAC Rule 450-101). All soil and debris removed from the Plain City Canal will be presumed to contain F001 through F005 listed wastes because of previous sampling results and generator knowledge of disposal activities. Therefore, all soil is initially destined to be disposed in a RCRA hazardous waste landfill and will be subject to LDRs. However, if during sampling and analysis, as described in Appendix B of the ROD, contaminants in any soil samples are determined to be below the analytical detection limits for the acceptable analytical methods for determining "F" listed wastes, that unit of soil represented by the sample(s) will be considered to be outside of CERCLA jurisdiction and may be taken to an industrial waste landfill. Also, if any other contaminants that are subject to LDRs, such as dioxins, are detected in the samples, the soils containing those contaminants will be subject to RCRA Subtitle C requirements. While not required under CERCLA, disposal of soils that do not contain listed or characteristic hazardous wastes in a RCRA industrial landfill is being undertaken by DDOU to remove the potential for this material to act as a source of ground-water contamination at DDOU.

Ground water in the shallow Class II aquifer at OU 1 would be extracted through a sufficient number of wells to achieve a total flow rate of approximately 75 to 100 gallons per minute. The number of wells required to achieve this flow rate would be determined by pump testing extraction wells during installation. It has been estimated that approximately 12 wells would be required to achieve this flow rate. Following extraction,

the ground water would be treated by air stripping and GAC, if necessary, and reinjected into the aquifer around the perimeter of the vinyl chloride contamination plume. A GAC system would be added to the air stripper if dioxins and furans were detected in the effluent at concentrations that produce a cancer risk of greater than one in ten thousand. The GAC system would reduce the excess cancer risks to less than one in ten thousand with a target of one in one million. Wastes from the ground-water treatment process would be transported off site for incineration or land disposal depending on how the wastes are classified under RCRA.

Ground-water remediation would be protective of the environment and would eventually achieve Federal and State MCLs for vinyl chloride and TCE that are considered to be ARARs. The area of attainment for these ARARs is defined by the areal extent of vinyl chloride contamination above its MCL. This is an area of approximately 32 acres and includes approximately 56 million gallons of ground water.

The time frame required for compliance with ground-water MCLs for vinyl chloride and TCE is estimated to be a minimum of five years, assuming treatment of a minimum of five pore volumes (approximately 280 million gallons) will be necessary to attain ARARs. However, the ability of the pump and treat technology to achieve very low residuals (less than 2 ug/L for vinyl chloride) in ground water may be limited, as evidenced by EPA experience with other sites where standard extraction systems are often not suitable for removing all of the contaminants present in the aquifer material. Compliance with ground-water cleanup criteria would be determined using selected compliance monitoring wells. The treatment system would be operated until contaminant levels were maintained below cleanup levels for one year. Monitoring would continue until the next scheduled statutory 5-year review. If cleanup criteria were exceeded within this period, ground-water treatment would recommence.

The air stripper vapor emissions are expected to be orders of magnitude less than the Utah ARAR for air emissions which is 1.5 tons of total VOCs per year. The air stripper emissions are not expected to exceed the emission concentration standard for vinyl chloride (10 parts per million) of the National Emission Standards for Hazardous Air Pollutants (NESHAPS), as defined in 40 CFR Part 61 that are considered relevant and appropriate. The disposal of any spent GAC would comply with the land disposal restrictions ARAR by testing the GAC to determine whether it contains VOCs above treatment standards or other contaminants that may exhibit hazardous characteristics under TCLP. If test results indicate that spent GAC contains VOCs above treatment standards or exhibits hazardous characteristics, and treatment by fixation/stabilization failed, it would be treated by incineration to meet treatment standards prior to disposal in a RCRA hazardous waste landfill. The indirect, capital, operating and maintenance costs associated with this alternative are presented in Table 3, as are estimates of present net worth costs based on a 5-year remediation time frame and a statutory review every five years.

This alternative, and those presented below, will not affect any endangered species or their habitats. This view has been confirmed through discussions with the Fish and Wildlife Service. The alternative will not affect any wetlands because there are none at DDOU or in the vicinity that would be impacted by remedial actions.

4.3.3 Alternative 3 - Off-Site Soil Incineration and Ground-Water Treatment by Air Stripping/GAC

Contaminated soil (4,000 cubic yards) in the Plain City Canal would be excavated and transported to an off-site RCRA permitted incineration facility. While not a significant risk to human health, incineration of Plain City Canal soils would be protective of the environment by removing the source of vinyl chloride, dioxin, and furan contamination observed in the ground water and achieving complete destruction of the soil contaminants. Excavation would continue until soils remaining on site contain less than 25 mg/kg of PCBs, less than 1 ug/kg total equivalent 2,3,7,8-TCDD, and present a health risk of less than one in ten thousand, with a target of one in one million for the remaining contaminants. This remedial action would take a few months to complete and would be conducted within 15 months to two years after the ROD is signed.

Because the soils in the Plain City Canal contain dioxins and furans, they must be incinerated at a facility permitted for dioxin destruction that is capable of achieving a 99.9999 percent destruction and removal efficiency. The Plain City Canal soils would be incinerated and the waste residue disposed of in compliance with the F001 listed waste treatment standards. The treated debris would be monitored using TCLP extract for compliance with F001 listed waste treatment standards and to ensure that dioxin and furan concentrations in the TCLP extract are less than 1 ug/kg for each of the tetra, penta, and hexa-dioxin and furan isomers prior to land disposal. However, this is contingent on identification of an incinerator permitted to receive and treat dioxin and furan contaminated material. Currently, no such facility exists in the United States. Therefore, implementation of this alternative is impossible at this time.

The method of ground-water remediation has been discussed under Alternative 2. The indirect, capital, operating and maintenance costs associated with this alternative are presented in Table 3, as are estimates of present net worth costs based on a 5-year remediation time frame and a statutory review every five years.

4.3.4 Alternative 4 - Off-Site Landfill Disposal of Soil and Ground-Water Treatment by Spray Aeration/GAC

Contaminated soil in the Plain City Canal would be excavated and transported to an off-site facility for placement in a RCRA permitted hazardous waste or industrial landfill depending on waste classification, as described in Alternative 2. Ground water would be extracted from the shallow aquifer using wells, sprayed into a lined pond, pumped from the pond through a GAC system, if necessary, and reinjected into the shallow aquifer along the margin of the vinyl chloride plume. Wastes from the ground-water treatment process would be transported off site for incineration or land disposal depending on how the wastes are classified under RCRA. As the method of ground-water treatment differs from that described under Alternative 2 only in the use of a spray aeration pond in place of an air stripper, remediation times and ARARs compliance would be similar to those presented for Alternative 2. Treatability testing would be required to evaluate the seasonal performance of this system. The indirect, capital, operating and maintenance costs associated with this alternative are presented in Table 3, as are estimates of present net worth costs based on a 20-year monitoring period and a statutory review every five years.

4.3.5 Alternative 5 - Off-Site Soil Incineration and Ground-Water Treatment by Spray Aeration/GAC

Contaminated soil in the Plain City Canal would be excavated and transported to an off-site incineration facility, as described in Alternative 3. Ground water would be extracted from the shallow aquifer using wells or trenches, sprayed into a lined pond, pumped from the pond through a GAC system, if necessary, to remove dioxins and furans and reinjected into the shallow aquifer along the margin of the vinyl chloride plume, as described in Alternative 4. Wastes from the ground-water treatment process would be transported off site for incineration or land disposal, depending on how the wastes are classified. The indirect, capital, operating and maintenance costs associated with this alternative are presented in Table 3, as are estimates of present net worth costs based on a 5-year remediation time frame and a statutory review every five years.

4.4 COMPARATIVE ANALYSIS OF REMEDIATION ALTERNATIVES

During the detailed analysis of remediation alternatives for OU 1, each alternative was assessed against the nine evaluation criteria defined under the NCP. These criteria were developed to address the technical and policy considerations that have proven important for selecting among remedial alternatives and serve as a basis for the detailed analysis, assessment, and the subsequent selection of an appropriate remedial action. In assessing alternatives, all must meet criteria 1 and 2, which are the threshold criteria. Those alternatives satisfying the threshold criteria are compared using the five balancing criteria. The final two modifying criteria can change the preferred alternative selected as a result of applying the balancing criteria. The evaluation criteria are described below:

Threshold Criteria

Threshold criteria used in the comparative analysis include overall protection of human health and the environment and compliance with ARARs. These threshold criteria must be met by an alternative before it can be evaluated under the five balancing criteria.

1. Overall Protection of Human Health and the Environment - The assessment against this criterion describes how the alternative, as a whole, achieves and maintains protection of human health and the environment.

2. Compliance with ARARs - The assessment against this criterion describes how the alternative complies with ARARs or, if a waiver is required, how it is justified. The assessment also addresses other information from advisories, criteria, and the guidance that the parties have agreed is "to be considered."

Balancing Criteria

The five balancing criteria form the basis of the comparative analysis because they allow tradeoffs among the alternatives involving different degrees of performance.

3. Long-Term Effectiveness and Permanence - The assessment of alternatives against this criterion evaluates the long-term effectiveness of each alternative in protecting human health and the environment after the response objectives have been met.

4. Reduction of Mobility, Toxicity, and Volume Through Treatment The assessment against this criterion evaluates the anticipated performance of the specific treatment technologies an alternative may employ.

5. Short-Term Effectiveness - The assessment against this criterion examines the effectiveness of alternatives in protecting human health and the environment during the construction and implementation of a remedy and until the response objectives have been met. 6. Implementability - The assessment against this criterion evaluates the technical and administrative feasibility of the alternatives and the availability of the goods and services needed to implement them.

7. Cost - The assessment against this criterion evaluates the capital, indirect, and operation and maintenance costs of each alternative. Cost can only be a deciding factor for alternatives equally protective of human health and the environment.

Modifying Criteria

8. State Acceptance - This criterion reflects the State's preferences among or concerns about alternatives.

9. Community Acceptance - This criterion reflects the community's preferences among or concerns about alternatives.

The results of the assessment of alternatives against the nine criteria were arrayed to compare the alternatives and identify the key tradeoffs among them (Table 3). A comparative analysis of the alternatives was then conducted to evaluate the alternatives with respect to their relative performance according to the threshold and balancing criteria. The objective of the comparison is to assess the relative advantages and disadvantages among the alternatives. The results of this comparison are presented below.

4.4.1 Overall Protection of Human Health and the Environment

Assuming that present land practices at DDOU remain unchanged, all of the remedial alternatives presented in this detailed analysis would be equally protective of human health and the environment because there are currently no exposure pathways to contaminated soil or ground water at OU 1. Under all remedial alternatives except the no-action alternative, the risks to human health due to exposure to contaminated soil would be reduced because contaminated soils would be excavated and disposed of off site (Alternatives 2 and 4) or incinerated (Alternatives 3 and 5). Under Alternative 1, the no action alternative, lack of action may result in off-site migration of contaminated ground water in the future. While there is currently no domestic or on-Depot use of the shallow ground-water aquifer in the vicinity of OU 1, the future risk to the public would increase under these conditions. All other alternatives would prevent off-Depot migration of the ground water and would reduce risks associated with potential future use of on-Depot shallow ground water. Therefore, Alternative 1 may fail to meet these criteria in the future. Although Alternatives 2 and 4, which include off-site landfilling of Plain City Canal soils, comply with this criterion, Alternatives 3 and 5, which result in the complete destruction of contaminants in the soil and ground water, have the highest degree of protectiveness.

4.4.2 Compliance with ARARs

Under Alternatives 2 and 4, Plain City Canal soils and debris that contain listed wastes or exhibit the characteristics of a hazardous waste as defined by RCRA would be placed in a RCRA hazardous waste landfill. Knowledge of the history of the Plain City Canal material indicates that the material may have once contained F001 listed wastes, although testing to date indicates that this material does not contain RCRA listed wastes. However, while not required under CERCLA, if the soils and debris from the Plain City Canal do not contain a RCRA listed waste or exhibit the characteristics of a hazardous waste as defined by RCRA, under Alternatives 2 and 4, they will be placed in a RCRA industrial landfill. Incineration alternatives (Alternatives 3 and 5) would comply with ARARs if a 99.9999 percent destruction and removal efficiency incinerator permitted for dioxin and furan destruction were available.

The no action alternative (Alternative 1) would fail to meet ARARs for remediation of ground water because vinyl chloride currently exceeds its MCL. However, the no-action alternative is not required to comply with ARARs. All other alternatives would result in eventual compliance with ARARs for ground water, given the limitations of pump and treat technology. Although the time frame for compliance has been estimated as 5 years, the actual cleanup time would depend on the response of the aquifer during remediation.

4.4.3 Long-Term Effectiveness and Permanence

The no action alternative would provide the least compliance with this criterion. Alternatives 2 through 5 would comply with this criterion to some degree due to the remediation of the shallow aquifer that would occur under each. However, the permanence of landfilling of contaminated soils under Alternatives 2 and 4 rates lower than the complete destruction by incineration that would be achieved in Alternatives 3 and 5. Therefore, Alternatives 3 and 5 rate highest under this criterion.

4.4.4 Reduction in Mobility, Toxicity, and Volume Through Treatment

Alternative 1 rates lowest under this criterion because no action would be taken to remediate contaminated soil and ground water. Alternatives 2 through 5 rate higher than Alternative 1 due to the remediation of the shallow aquifer that would be achieved under each. Alternatives 3 and 5 rate highest overall due to the complete destruction of contaminants in the soil that would occur under those alternatives.

4.4.5 Short-Term Effectiveness

With the exception of Alternative 1, all of the alternatives compare equally under this criterion. As no action would be taken under Alternative 1, there are no short-term risks to be considered under current land use. All other alternatives involve similar risks created by the methods that would be used to excavate and treat the contaminated soil and ground water at OU 1. These risks could be minimized by use of standard worker protective equipment during the few months that excavation would occur. Risks due to ground-water treatment would be limited to those associated with air-stripper emissions. These would be minimized by compliance with NESHAPS and the State of Utah Clean Air Act, and the use of emission control technology, if necessary.

4.4.6 Implementability

The no action alternative would be the easiest alternative to implement. Alternatives 2 and 4 would be easier to implement than Alternatives 3 and 5. Under Alternatives 3 and 5, off-site soil incineration would require a facility permitted for destruction of dioxins and furans. Therefore, implementation of these alternatives may not be possible because no incineration facilities in the U.S. are currently permitted for thermal destruction of dioxins and furans. The spray aeration/GAC remediation alternatives may require limited treatability studies because of reduced efficiency during winter months. Air stripping/GAC treatment of ground water under Alternatives 2 and 3 may be the easiest ground-water treatment processes to implement technically because of readily available prefabricated components. Therefore, Alternative 1 would be the easiest to implement, followed by Alternative 2, Alternative 4, Alternative 3, and finally Alternative 5.

4.4.7 Cost

The no action alternative (Alternative 1) has the lowest cost of all the alternatives considered, with a present worth value of $255,000 (Table 3). Alternatives 2 and 4 both have present worth values of approximately $2.2 million. Alternatives 3 and 5, both of which employ off-site soil incineration, are the most costly, with present worth values of approximately $15 million each.

4.4.8 State Acceptance

The State has been involved in each step of the RI/FS process and the presentation of the preferred alternative in the Proposed Plan for OU 1. Therefore, this criterion has been addressed in the development of a remedy for OU 1. The State is supportive of the selected remedy, but had a preference for off-site incineration of all soil and debris. However, as stated under the description of alternatives that employ incineration, this is not currently implementable.

4.4.9 Community Acceptance

Community acceptance is implicitly analyzed for the selected remedy in the Responsiveness Summary at the end of this document. All comments received during the public comment period have been addressed and the alternatives altered. Therefore, public concerns regarding the selection of a remedy for OU 1 have been addressed.

5.0 SELECTED REMEDY

The selected remedy for DDOU Operable Unit 1 is Alternative 2, offsite landfill disposal of soil and debris and on-site ground-water treatment using air stripping and, if necessary, GAC. This remedy was presented as the preferred alternative in the Proposed Plan for OU 1 and has the support of the State and EPA. Because the State has been intimately involved in the RI/FS process at OU 1, State acceptance of the selected remedy has been achieved through incorporation of State comments on primary documents prepared in support of this ROD, and included in the Administrative Record. Community acceptance of the selected remedy has been achieved through the Community Relations Program, public meetings, and the public comment period. A detailed description of the selected alternative, including the remediation goals, cleanup levels, and the costs associated with each component of the remedy is presented in the following discussion.

5.1 DESCRIPTION OF THE SELECTED REMEDY

Under Alternative 2, backfilled soil and debris from the Plain City Canal will be excavated and transported off site for landfill disposal at a RCRA permitted facility. All soil and debris removed from the Plain City Canal will be presumed to be contaminated with F001 through F005 listed wastes because of the "Contained-in Rule" and previous generator knowledge of disposal activities. Therefore, all soil is initially destined to be disposed in a RCRA hazardous waste landfill and will be subject to LDRs. However, if during sampling and analysis, as described in Appendix B of the ROD, contaminants in any soil sample are determined to be below the analytical detection limits for the acceptable analytical methods for determining "F" listed wastes, that unit of soil represented by the sample(s) will be considered to be outside of CERCLA jurisdiction and may be taken to an industrial waste landfill. Also, if any other contaminants that are subject to LDRs, such as dioxins, are detected in the samples, the soils containing those contaminants will be subject to RCRA Subtitle C requirements.

The excavation will be backfilled with clean soil, regraded, and revegetated. It is estimated that removal of approximately 4,000 cubic yards of soil from the Plain City Canal will eliminate contamination in this area.

Ground water will be extracted through approximately 12 extraction wells at a combined flow rate of approximately 75 to 100 gallons per minute, and treated by air stripping to remove contaminants. A GAC system will be added to the air stripper if dioxins and furans are detected in the effluent at concentrations above the proposed MCL for dioxins and furans of 5 x 10[-5] ug/L. This concentration corresponds to a risk level of one in one ten thousand. Exhaust air from the air stripper will be vented to the atmosphere, while treated water will be used to recharge the aquifer using injection wells. Air emissions from the air stripper tower will be monitored to ensure compliance with the Utah Clean Air regulatory limit of 1.5 tons of total VOCs per year and the NESHAPS requirements for vinyl chloride of 10 parts per million, using an in-stack monitoring point. If emission levels threaten or exceed these criteria, air emission controls such as GAC or some other technology will be employed to ensure compliance. Wastes from the ground-water treatment process will be transported off-site for incineration or land disposal depending upon how the wastes are classified under RCRA.

The ground-water treatment system will be operated either continuously, by pulsing the system, turning off individual wells, or pumping alternate wells to vary ground-water flow patterns. Such measures will be taken to reduce the remediation time frame where practicable while ensuring compliance with ground-water and air emissions ARARs. The ground-water treatment system will be operated until the remediation goals for ground water outlined below have been met and maintained for one year in all compliance monitoring wells. When contaminant concentrations have been maintained below MCLs for one year, the treatment system will be shut down but compliance monitoring will continue until the next scheduled statutory five-year review. If remediation goals are exceeded during this time in any compliance monitoring well, ground-water treatment will recommence and this procedure will be repeated. If compliance is maintained until the next scheduled statutory review, the remedy will be considered complete. Compliance monitoring is discussed in more detail in Appendix B of this document.

During construction of the extraction and reinjection wells, a pumping test will be conducted on each well as it is completed. The number, spacing, and pumping rate of extraction and injection wells will be adjusted according to the results of these tests. The process components of this alternative and pertinent information and assumptions on sizing, concentrations, flow rates, etc., are presented in Table 4. It should be noted that some changes may be made to this remedy during the remedial design and construction phases of the project.

5.1.1 Remediation Goals

The point of compliance for soil will be defined by the clean-up criteria described below. The first of these criteria consists of removing all debris and visually contaminated soils from the Plain City Canal. Visually contaminated soil is defined as any soil containing manufactured or processed material, plant or animal matter, or unnatural discoloration. Samples will be collected from the soil in the walls and bottom of the excavation and analyzed for VOCs, PCBs, dioxins, furans, and metals. These sample results will be used to confirm that the soils remaining in the excavation:

1. Do not contain more than 25 mg/kg of PCBs, as recommended in EPA Directive 9355.4-01FS.

2. Do not contain dioxin and furan concentrations of more than 1 ug/kg total equivalent 2,3,7,8-TCDD, as recommended by the Dioxin Advisory Council.

3. Do not contain other contaminants that would present an unacceptable future health risk. Excavation will continue until a total carcinogenic health risk of less than one in ten thousand is achieved in the soils remaining in the excavation. In addition, a target cleanup level of one in one million has been adopted for OU 1 and will be achieved wherever practicable. Similarly, excavation will continue until the hazard index for noncarcinogenic contaminants remaining in the soil is less than one. Contaminant concentrations associated with these health risks are presented in Table A-2 in Appendix A, assuming a future resident exposure scenario. Risk based cleanup levels are only defined for those contaminants that do not have specifically defined cleanup levels.

During the excavation process, excavated soil and debris will be periodically tested using appropriate methods, including the Toxicity Characteristics Leaching Procedure (TCLP) for compliance with treatment standards for F001 listed waste, dioxins, and furans. These tests will determine whether the excavated material must be placed in a RCRA hazardous waste or industrial landfill, and whether any treatment will be necessary prior to disposal.

The point of compliance for ground-water cleanup is defined by the area within the 2 ug/L contour for vinyl chloride. Cleanup levels for groundwater contaminants at OU 1 are listed in Table A-1 in Appendix A. Ground water will be treated until contaminant concentrations are below their MCLs in all OU 1 ground-water compliance samples. When these goals are met, the shallow ground water will be available for beneficial use. However, the ability of pump and treat technology to achieve and maintain low contaminant levels may be limited, as evidenced by experience at other sites.

A Performance and Ground-Water Compliance Monitoring Plan for soil and ground-water remediation at OU 1 is presented in Appendix B. This plan summarizes the remediation goals, areas of attainment, restoration time frame, and the performance standards for soil and ground-water remediation.

5.1.2 Costs

The costs associated with remediation of OU 1 using Alternative 2 are listed in Table 4. The total capital cost of the project is estimated at approximately $1,320,000. This includes costs of installing a ground-water extraction and injection system, storage tank, an air-stripping system, equipped with GAC if necessary, ground-water monitoring, excavation, soil disposal at a RCRA permitted hazardous waste landfill, and reclamation of the site. The disposal costs for a RCRA hazardous waste landfill have been used to assess disposal costs. While some soil may be placed in a RCRA industrial landfill and the disposal costs for this are approximately 50 percent lower than a RCRA hazardous waste landfill, the volume of soil that may be disposed of in this way will be dependent on results of sample analyses during site remediation. Indirect costs for administration, engineering, and design services were estimated to be approximately $200,000, while annual operation and maintenance costs are estimated at $146,000. The present worth cost of the project, using a five percent discount value, is estimated at $2.2 million, based on a 7year duration of treatment and monitoring.

5.2 STATUTORY DETERMINATIONS

The selected remedy for OU 1 meets the statutory requirements of Section 121 of CERCLA as amended by SARA. These statutory requirements include protection of human health and the environment, compliance with ARARs, cost effectiveness, utilization of permanent solutions and alternative treatment technologies to the maximum extent practicable, and preference for treatment as a principal element. The manner in which the selected remedy for OU 1 meets each of these requirements is presented in the following discussion.

5.2.1 Protection of Human Health and the Environment

The selected remedy for OU 1 protects human health and the environment through the following engineering controls:

- Excavation and removal of all backfilled soil and debris from the Plain City Canal to comply with the cleanup criteria defined in Section 5.1.1., and

- Extraction and treatment of all ground water until contaminant concentrations are below their MCLs.

Removal of the contaminated soil and debris in the Plain City Canal will eliminate a source of contamination in the ground water and remove the potential for exposure to these contaminants in soil. Treatment of contaminated ground water at OU 1 to a level below the MCLs will reduce the health risks to potential future ground-water users by approximately two orders of magnitude. The selected remedy for soil and ground water at OU 1 will not pose an unacceptable short-term risk and will have the effect of minimizing cross-media impacts. This latter point will be achieved by ensuring compliance with Utah air regulations and Federal requirements for vinyl chloride defined by NESHAPS.

5.2.2 Compliance with Applicable or Relevant and Appropriate Requirements

Section 121(d)(1) of CERCLA as amended by SARA, requires that remedial actions must attain a degree of cleanup that assures protection of human health and the environment. In addition, remedial actions that leave any hazardous substances, pollutants, or contaminants on site must, upon completion, meet a level or standard that at least attains legally applicable or relevant and appropriate standards, requirements, limitations, or criteria that are "applicable or relevant and appropriate requirements" (ARARs) under the circumstances of the release. ARARs include Federal standards, requirements, criteria, and limitations and any promulgated standards, requirements, criteria, or limitations under State environmental or facility siting regulations that are more stringent than Federal standards.

"Applicable" requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address a hazardous substance, pollutant or contaminant, remedial action, location, or other circumstance at a remedial action site. "Relevant and appropriate" requirements are cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that, while not "applicable" to a hazardous substance, pollutant or contaminant, remedial action, location, or other circumstance at a remedial action site, address problems or situations sufficiently similar to those encountered at the site that their use is well-suited to the particular site.

In determining which requirements are relevant and appropriate, the criteria differ depending on the type of requirement under consideration, i.e., chemical-specific, location-specific, or action-specific. According to the NCP, chemical-specific ARARs are usually health or risk-based numerical values that establish the acceptable amount or concentration of a chemical that may remain in, or be discharged to, the ambient environment. Location specific ARARs generally are restrictions placed upon the concentration of hazardous substances or the conduct of activities solely because they are in special locations. Some examples of special locations include floodplains, wetlands, historic places, and sensitive ecosystems or habitats. Action-specific ARARs are usually technology- or activity-based requirements or limitations on actions taken with respect to hazardous wastes, or requirements to conduct certain actions to address particular circumstances at a site. Remedial alternatives that involve, for example, closure or discharge or dredged or fill material may be subject to ARARs of RCRA and the Clean Water Act.

The remedial action proposed, the hazardous substances present at the site, the physical characteristics of the site, and the potential receptor population, were all considered when determining which requirements are applicable or relevant and appropriate to the selected remedy for OU 1. Federal and State laws, standards, requirements, criteria, and limitations were reviewed for possible applicability to the OU 1 site. The only State regulations identified that required more stringent requirements than equivalent Federal regulations were the source control requirements of UAC Rule 450-101 and the spill reporting requirements of UAC Rule 450-9.

Through careful review of all applicable or relevant and appropriate public health and environmental requirements of Federal of State laws, it has been determined that the remedy selected for OU 1 will meet these ARARs. Therefore, no SARA Section 121(d)(4) waiver will be necessary. A brief discussion of how the selected remedy for OU 1 satisfies the principal ARARs associated with the site is presented below.

5.2.3 Chemical-Specific Requirements

Chemical-specific ARARs set health- or risk-based concentration limits in various environmental media. Ground-water quality ARARs for OU 1 are based on the Safe Drinking Water Act maximum contaminant level (MCL), the maximum permissible level of a contaminant in water that is delivered to any user of a public water system. MCLs are generally relevant and appropriate as cleanup standards for contaminated ground water that is or may be used for drinking. The State of Utah public drinking water regulations are also relevant and appropriate to the OU 1 selected remedy. In addition, the Utah ground-water quality protection and air quality regulations are applicable to the site. Other applicable or relevant and appropriate requirements include the NESHAPS standards defined in the Clean Air Act, the Occupational Safety and Health Administration (OSHA) regulations, and the Department of Transportation (DOT) hazardous material transportation regulations. Potential Federal and State chemical-specific ARARs are presented in Appendix C, Tables C-1 and C-2, respectively.

5.2.4 Location-Specific Requirements

Location-specific ARARs set restrictions on remediation activities, depending on the location of a site or its immediate environs. The only location-specific ARAR associated with the selected remedy for OU 1 is the EPA ground-water protection strategy that establishes a ground-water classification system for protecting ground water based on its value to society, use, and vulnerability. This strategy contributes to application of the National Primary Drinking Water Standards as ARARs for the selected remedy. As OU 1 is not located in a wetlands area or flood plain, is not a historic place, and the remedy will not affect any historic place, endangered species or habitat, regulations pertaining to these concerns are not ARARs.

5.2.5 Action-Specific Requirements

Performance, design, or other action-specific requirements set controls or restrictions on certain kinds of remedial activities related to management of hazardous substances, pollutants, and contaminants. Federal action-specific ARARs that are relevant to the remediation activities at OU 1 include Federal Underground Injection Control Regulations, RCRA Land Disposal and Closure Regulations, and OSHA. State requirements include the Utah State Engineer's regulations for well construction and pumping activities, the Utah Corrective Action Cleanup Standards Policy for cleanup levels, and the Utah Air Quality Regulations. Potential Federal and State action-specific ARARs are presented in Tables C-3 and C-4 of Appendix C, respectively.

5.2.6 To Be Considered Requirements

In implementing the selected remedy for OU 1, DDOU has agreed to consider requirements that are not legally binding. The only requirements to be considered (TBC) for the selected remedy at OU 1 are the recommendations of the Dioxin Disposal Advisory Group regarding pentachlorophenol waste and dioxin and furan contamination and EPA Directive 9355.4-01FS that presents recommended cleanup levels for PCBs. This TBC is included in the Federal chemical-specific ARARs presented in Table C-1.

5.3 COST EFFECTIVENESS

Overall cost-effectiveness can be defined as the reduction in threat to human health and the environment per dollars expended on a remedy. The selected remedy for OU 1 is the most cost-effective alternative because it provides the maximum effectiveness proportional to cost of any of the alternatives analyzed.

5.4 UTILIZATION OF PERMANENT SOLUTIONS

This section briefly explains how the remedy provides the best balance of tradeoffs among all the alternatives with respect to the five balancing criteria described in Section 4.4. Implementability played an important part in the selection of Alternative 2 as a remedy. Because the Plain City Canal soils contain dioxins and furans, alternatives that employed incineration of soils to achieve the greatest reduction in mobility, toxicity, and volume would be impossible to implement because an incinerator permitted for dioxin and furan destruction is currently not available. Therefore, Alternatives 2 and 4 would be more implementable than Alternatives 3 and 5. In addition, the proven technology employed for ground-water remediation in Alternative 2, when compared to the use of surface impoundments and the difficulties in assuring consistent seasonal performance under Alternative 4, would make the technical implementation of Alternative 2 easier than Alternative 4.

While less effective than alternatives that employed incineration of soils (Alternatives 3 and 5), the long-term effectiveness of Alternatives 2 and 4 would be similar because both employ landfilling of Plain City Canal soils. Because all alternatives would employ treatment of ground water by extraction and removal of vinyl chloride prior to reinjection, they compared equally with respect to long term effectiveness for this media. The greatest degree of reduction in mobility, toxicity, and volume, would be achieved by those alternatives that employ incineration treatment of soil (Alternatives 3 and 5). However, these alternatives cannot be implemented. Therefore, the ground-water remediation technology was used to compare the remaining alternatives under this criterion. Because both the air stripping and GAC treatment under Alternative 2 and the surface impoundment and GAC treatment under Alternative 4 would effectively reduce toxicity, mobility and volume of contaminants in ground water through treatment, both compared equally under this criterion.

The short-term effectiveness of Alternatives 2 and 4 were also considered to be similar because both would result in similar risks to the environment, community, and remediation workers due to air emissions from the ground-water treatment process and during excavation of soils. Finally, the cost of Alternative 2 was comparable to that of Alternative 4 and significantly lower than Alternatives 3 and 5. Therefore, Alternative 2 was selected as the remedy for OU 1 because it is an implementable and effective remedy that achieves a reduction in the principal threat posed by the site in a cost effective manner.

5.5 PREFERENCE FOR TREATMENT AS A PRINCIPLE ELEMENT

The selected remedy for OU 1 utilizes permanent solutions and treatment technologies to the maximum extent practicable. Treatment of soil will only be undertaken if necessary to achieve compliance with land disposal restrictions under RCRA. The use of air stripping and GAC to remediate contaminated ground water satisfies the statutory preference for treatment and will reduce the principal threat of human ingestion or inhalation of VOCs present in contaminated ground water underlying the site.

5.6 DOCUMENTATION OF NO SIGNIFICANT CHANGES

The Proposed Plan for OU 1 was released for public comment in October 1991 and identified Alternative 2, Off-Site Landfill Disposal of Soil and Ground-Water Treatment by Air Stripping/GAC, as the preferred alternative for remediation of this operable unit. All written and verbal comments submitted during the comment period were reviewed. The conclusion of this review was that no significant changes to the preferred alternative were necessary prior to it becoming the selected remedy.

APPENDIX A

SOIL AND GROUND-WATER REMEDIATION CRITERIA

This appendix describes the remediation criteria for soil and ground water at Operable Unit 1 (OU 1). Criteria for ground-water contaminants must be met in each compliance monitoring well. Confirmational soil samples will be collected after removing debris and visibly contaminated soil from the Plain City Canal. Results of these sample analyses will be used to confirm that all material contaminated above the cleanup levels has been removed from the excavation.

Ground-Water Remediation Criteria

Contaminants of concern for ground-water remediation for OU 1 include cis-1,2-dichloroethene (cis-1,2-DCE), trichloroethene (TCE), and vinyl chloride. The remediation criteria for these compounds are their respective drinking water maximum contaminant levels (MCLs) of 70, 5, and 2 ug/L.

Table A-1 summarizes the cleanup criteria for each contaminant of concern in ground water, the potential cancer risk and hazard quotient associated with each contaminant at current concentrations, and the potential cancer risk and hazard quotient associated with each contaminant at the cleanup concentrations. These risks have been estimated assuming future use of the ground water as a residential source of drinking and shower water.

The cleanup criteria for 1,2-DCE and TCE are higher than the baseline concentrations of these compounds. These criteria have been included because in some cases, samples from individual wells have higher concentrations than the baseline concentration, which is derived from an average concentration of several wells.

Soil Remediation Criteria

Contaminants of concern for soil remediation include arsenic, lead, zinc, PCBs, dioxins, furans, cis-1,2-DCE, TCE, and vinyl chloride. The "to be considered" (TBC) remediation criterion for PCBs of 25 mg/kg is based on EPA Directive 9355.4-01FS, "A Guide on Remedial Actions at Superfund Sites with PCB Contamination." The TBC criterion for dioxins and furans of 0.001 mg/kg was derived from the "General Approach Used by the Dioxin Disposal Advisory Group (DDAG) Regarding Pentachlorophenol Waste (also PCBs)" by P. des Rosiers, November 1988. Remediation criteria for TCE and vinyl chloride of 490 and 3.2 mg/kg, respectively, correspond to cancer risks of 1 x 10[-5] under a future residential soil ingestion scenario. The remediation criteria for cis-1,2-DCE and zinc are 70 and 1,500 mg/kg, respectively, which correspond to hazard quotients of 0.1 under this scenario. The criterion for arsenic of 35 mg/kg corresponds to a cancer risk of 1 x 10[-4]. An arsenic concentration that corresponds to a potential cancer risk of 1 x 10[-5] (3.5 mg/kg) is not practical at OU 1 because that concentration would be below naturally occurring background concentrations present at DDOU, whereas, the proposed criterion can be clearly distinguished from background levels. There is no reference dose or slope factor for lead, so a cleanup criterion corresponding to a hazard quotient of 0.1 or a cancer risk of 1 x 10[-5] cannot be established. The criterion for lead of 500 mg/kg is a typical remediation criterion for residential soils at CERCLA sites.

Risks for soil contaminants were calculated under a residential ingestion scenario where a person was assumed to be exposed as a 15 kg child ingesting 200 mg of soil per day for six years, and also as a 70 kg adult ingesting 100 mg of soil per day for 24 years. Table A-2 summarizes the remediation criteria, baseline risks, and postremediation risks for soil contaminants.

It should be noted that the criteria for most of the contaminants of concern for soil exceed the baseline concentrations detected in soil samples collected from the Plain City Canal. While there is no risk-based reason for remediating the soil at OU 1 for contaminants other than zinc, remediation criteria are necessary should hot spots be encountered where contaminant concentrations exceed previously detected concentrations.

APPENDIX B

PERFORMANCE AND COMPLIANCE MONITORING PLAN

PERFORMANCE AND COMPLIANCE MONITORING FOR REMOVAL OF PLAIN CITY CANAL SOIL AND DEBRIS

Remediation Goals

Remediation goals for soil are defined in Section 5.1.1. of the ROD.

Area of Attainment

The area of attainment for remediation goals is the backfill material in the Plain City Canal (PCC) as depicted in Figure 1 of the ROD. This consists of a 1,250-foot length of the canal, an assumed width of 20 feet, and contaminated soil and debris extending from approximately 2 feet to 6 feet below the ground surface. The volume of soil and debris requiring remediation is approximately 4,000 cubic yards. This estimate assumes the two feet of clean fill overlying the contaminated material in the PCC will be replaced in the excavation. Volume estimates may be revised during the Remedial Design/Remedial Action (RD/RA) based on soil sampling results.

Restoration Time Frame

The restoration time frame for this action is estimated to be approximately six months after commencement of work on site, and will be completed within 15 months to 21 months after the ROD is signed.

Performance Standards

Specific performance standards used to ensure attainment of the remediation goals for soil are:

- Reduce contaminant concentrations in soils within the area of attainment to comply with the remediation goals specified in Section 5.1.1. of the ROD.

- Meet all ARARs identified in the ROD for soil.

- The soil will be remediated in a timely manner in compliance with the selected remedy presented in the ROD to achieve remediation goals as soon as practicable.

Completion of Remediation

Remediation shall be considered complete after the soil remediation goals have been attained in all samples taken from the perimeter of the excavation. Samples to be used for compliance monitoring will be specified during Remedial Design (RD) in the Performance and Compliance Sampling Program. Sample locations will be approved by EPA and UDEQ during the RD. The number and location of samples to be taken may be modified during remediation to ensure compliance with remediation goals. The frequency of sampling will be determined during the RD. Any statistical methods to average soil concentrations areally or vertically shall be specified during the RD. The guidance entitled "Methods for Evaluating the Attainment of Cleanup Standards-Volume 1. Soils and Solid Media" (EPA 230/02-89-042) will be consulted when establishing the Performance and Compliance Sampling Program.

Performance and Compliance Monitoring Program

A Performance and Compliance Monitoring Program (PCMP) will be implemented during the remedial action to monitor performance and compliance with remediation goals. This program will be developed during the RD and will include locations of performance monitoring points within the PCC, frequency of monitoring, analytical parameters, sampling methods, analytical methods, and statistical methods for evaluating data. The PCMP will be included as part of the remedial design but may be modified during the remedial action to account for changed conditions.

PERFORMANCE AND COMPLIANCE MONITORING FOR REMEDIATION OF SHALLOW GROUND WATER

Remediation Goals

Remediation goals for shallow ground water are defined in Section 5.1.1. of the ROD.

Area of Attainment

The area of attainment for remediation goals is the volume of ground water containing vinyl chloride above its MCL of 2 ug/L. The volume of contaminated ground water within this plume is estimated at 56 million gallons.

Restoration Time Frame

The restoration time frame for this action is estimated to be approximately five years after commencement of work on site.

Performance Standards

Specific performance standards used to ensure attainment of the remediation goals for ground water are:

- Reduce contaminant concentrations in ground water within the area of attainment to comply with the remediation goals specified in Section 5.1.1. of the ROD.

- Meet all ARARs identified in the ROD for ground water.

- The ground water will be remediated in a timely manner, in compliance with the selected remedy presented in the ROD, to achieve remediation goals as soon as practicable.

Completion of Remediation

As described in Section 5.1 of the ROD, remediation of the ground water in the shallow aquifer will be considered complete when contaminant concentrations have been maintained below MCLs for a period of one year, whereupon the treatment system can be turned off. Monitoring of compliance wells will continue until the next statutory five-year review. If MCLs are exceeded within this time the treatment of ground water will recommence. Compliance monitoring well locations will be specified during the remedial design in the Performance and Compliance Monitoring Program and will be approved by EPA and UDEQ. The frequency of sampling may be modified during remediation to ensure compliance with remediation goals but will not be less than that detailed in Section 5.1 of the ROD.

Performance and Compliance Monitoring Program

A Performance and Compliance Monitoring Program (PCMP) will be implemented during the remedial action to monitor performance and compliance with remediation goals. This program will be developed during the RD and will include locations of performance monitoring points within the vinyl chloride plume, frequency of monitoring, analytical parameters, sampling methods, analytical methods, and statistical methods for evaluating data. The PCMP will be designed to provide information that can be used to evaluate the effectiveness of the selected remedy with respect to the following:

- Horizontal and vertical extent of the plume

- Contaminate concentration gradients

- Rate and direction of contaminant migration

- Changes in contaminant concentrations or distribution over time

- Containment of the plume

- Concentrations of contaminants in the treatment system influent and effluent.

The PCMP may be modified during the remedial action to account for changed conditions.

APPENDIX C

FEDERAL AND STATE CHEMICAL AND ACTION-SPECIFIC ARARs